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Cho et al.

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(54) **LENS ASSEMBLY**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

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G02B 7/02	(2006.01)
G02B 5/00	(2006.01)
G02B 13/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G02B 27/0018*** (2013.01); ***G02B 5/005*** (2013.01); ***G02B 7/021*** (2013.01); ***G02B 7/025*** (2013.01); *G02B 13/004* (2013.01)

(58) **Field of Classification Search**

CPC G02B 27/0018; G02B 7/021; G02B 7/025
USPC 359/601
See application file for complete search history.

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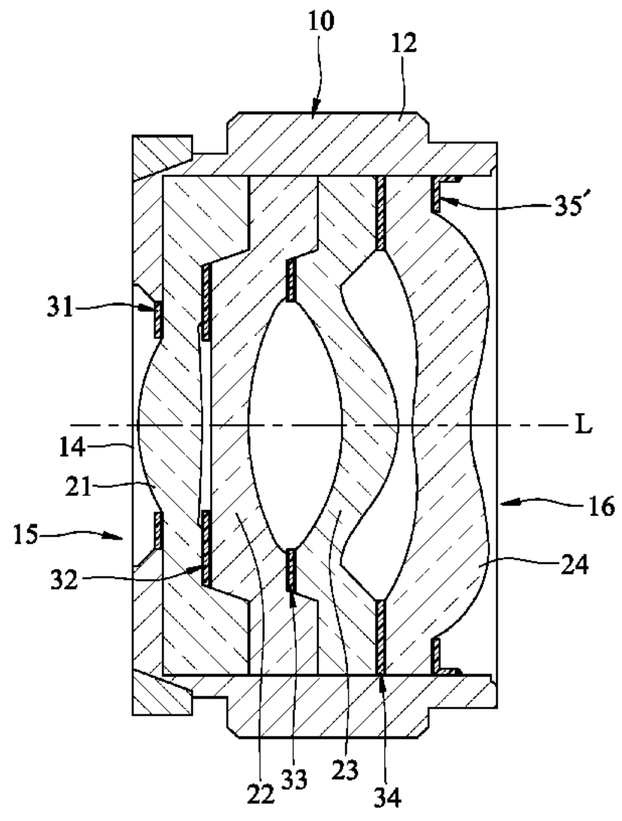
(57) **ABSTRACT**

A lens assembly includes a lens barrel, a plurality of lenses and at least one light-shielding member. The lens barrel extends along an axis and includes a peripheral wall that surrounds the axis and defines a receiving chamber. The peripheral wall has open and aperture-forming ends that are opposite to each other and respectively adjacent to image and object sides of the lens assembly. The lenses are disposed in the receiving chamber in sequence along the axis between the aperture-forming and open ends. The light-shielding member is disposed in the receiving chamber and includes an annular light-shielding body and an adhesive layer for positioning the annular light-shielding body relative to at least one of the lenses.

6 Claims, 8 Drawing Sheets



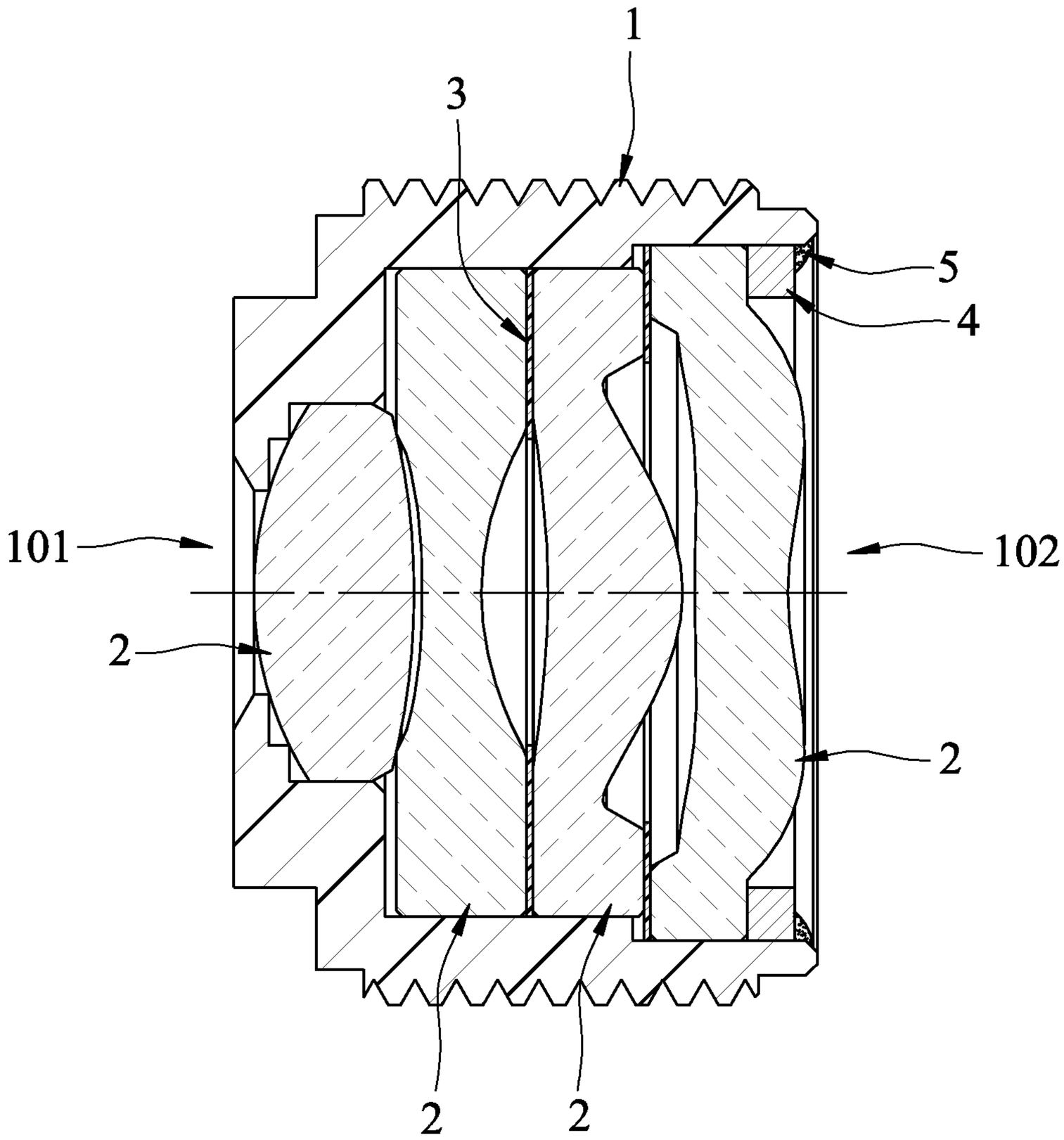


FIG.1
PRIOR ART

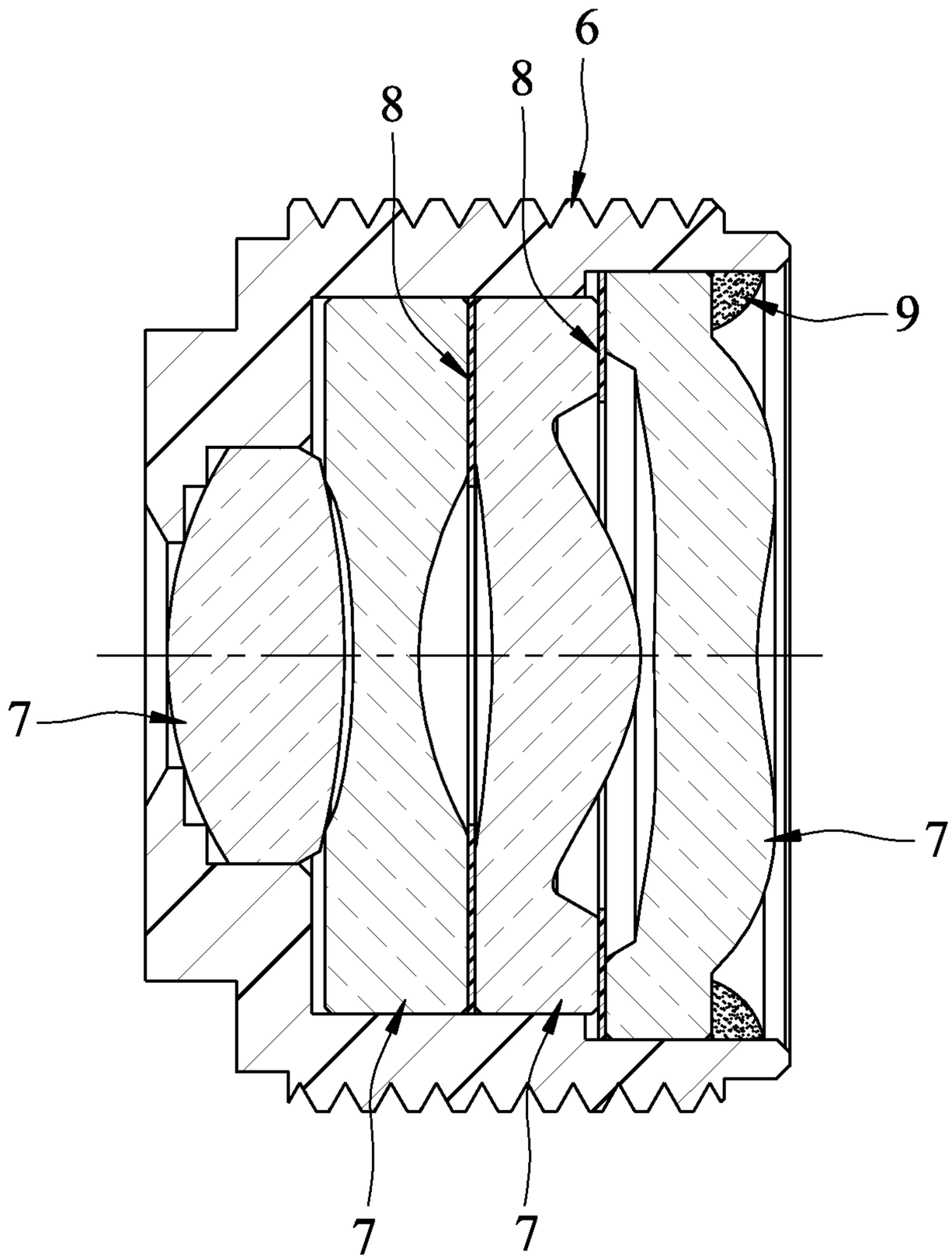


FIG.2
PRIOR ART

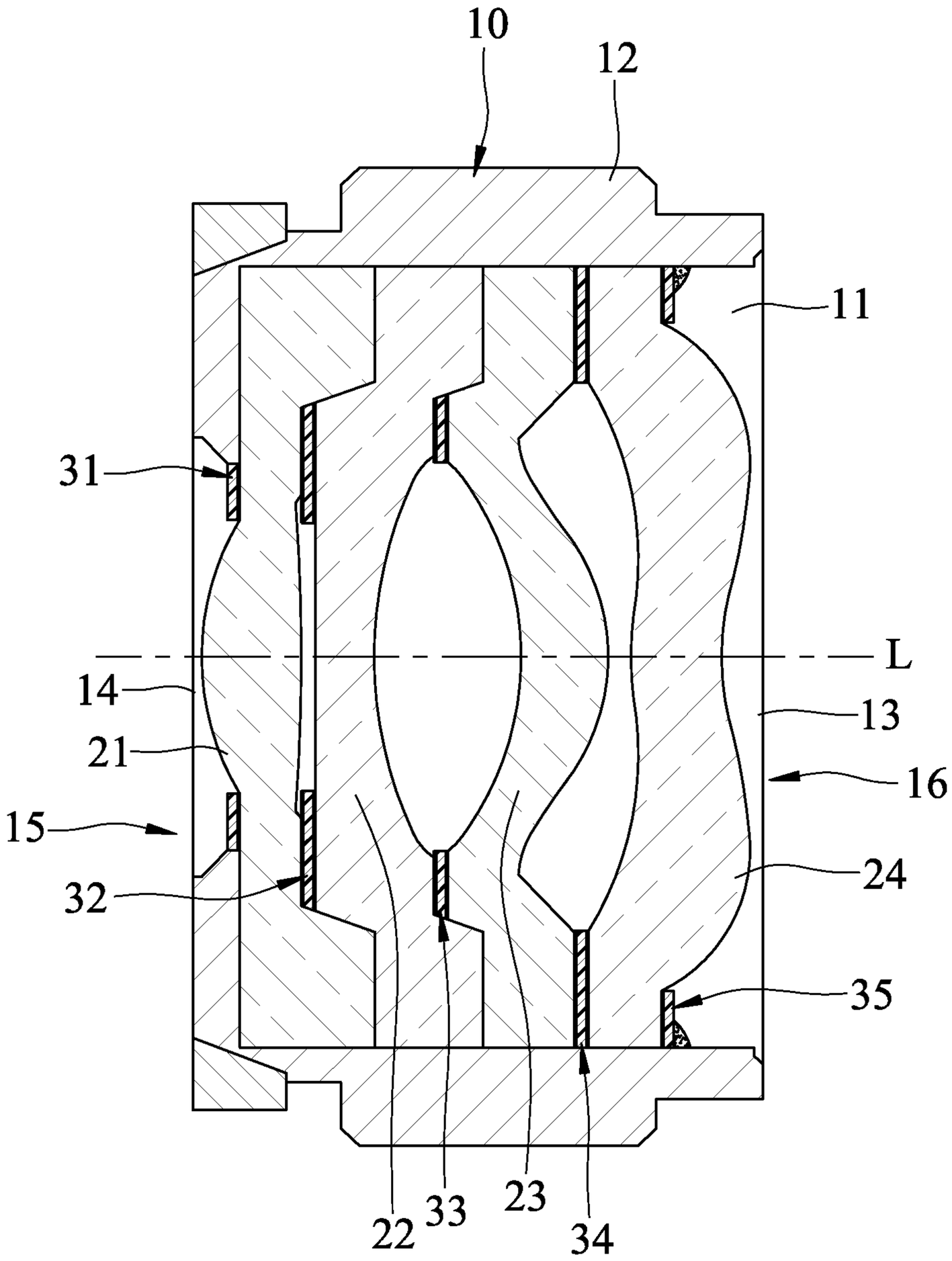


FIG.3

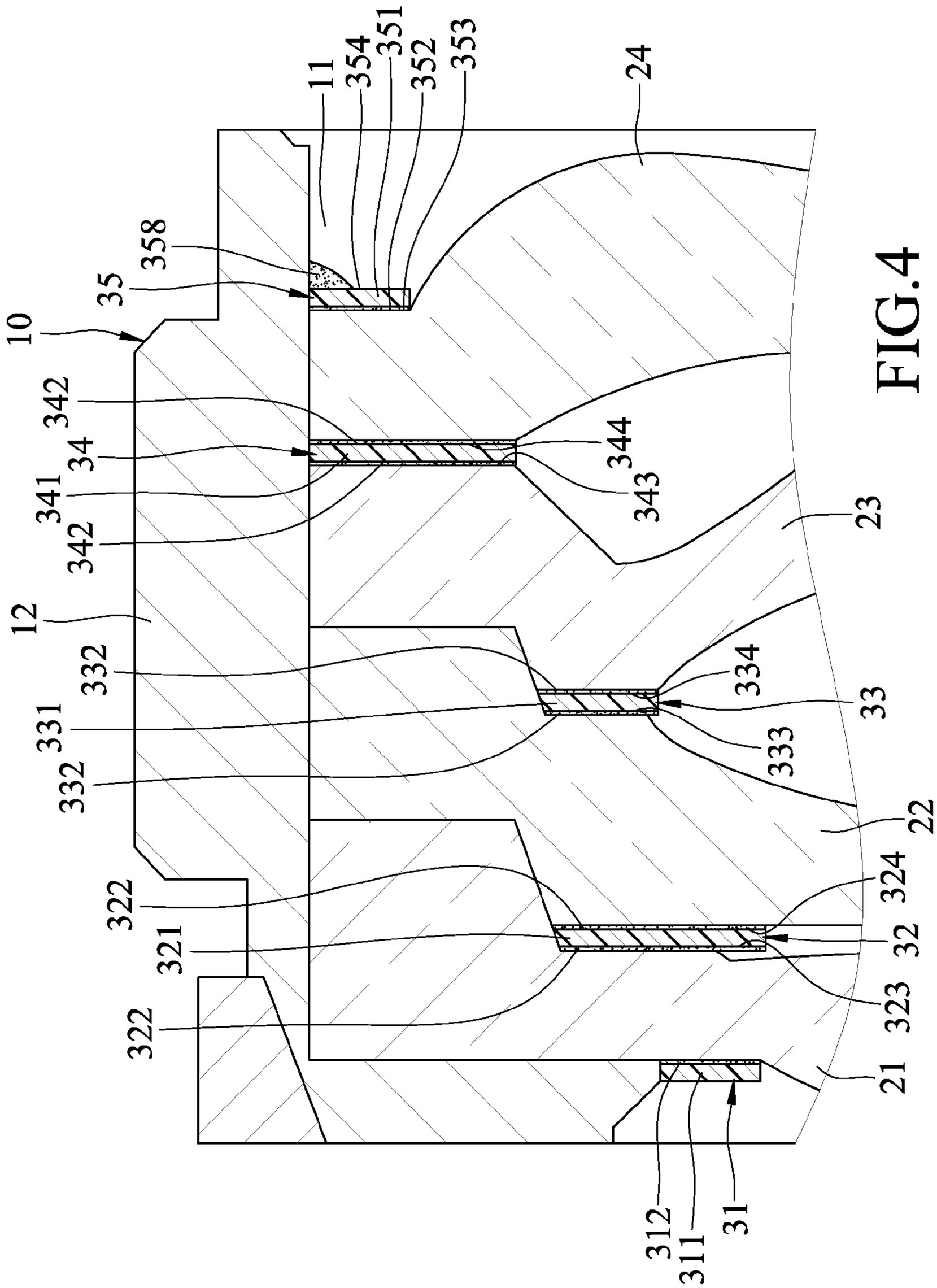

11
354
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FIG.4

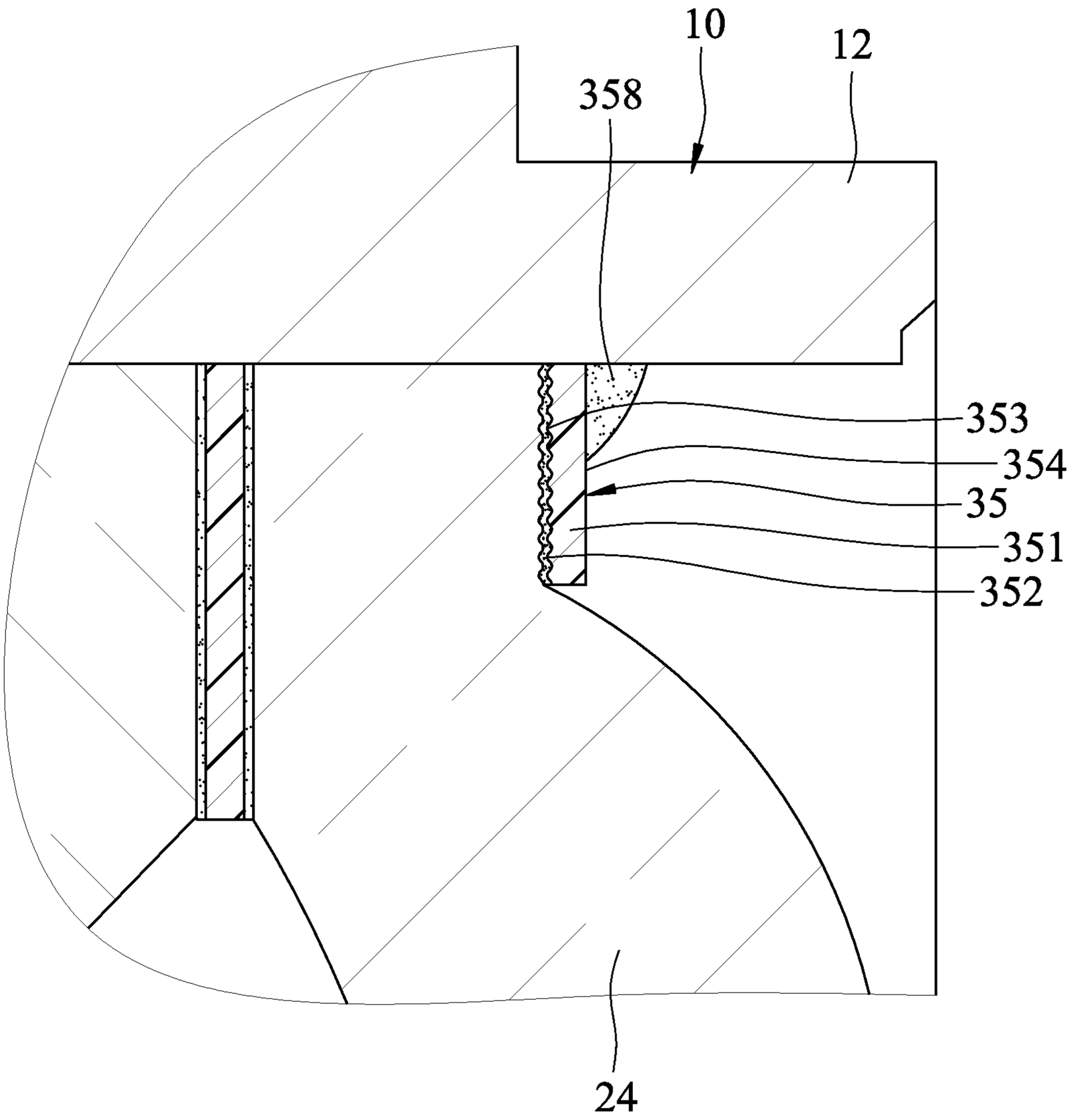

FIG.5

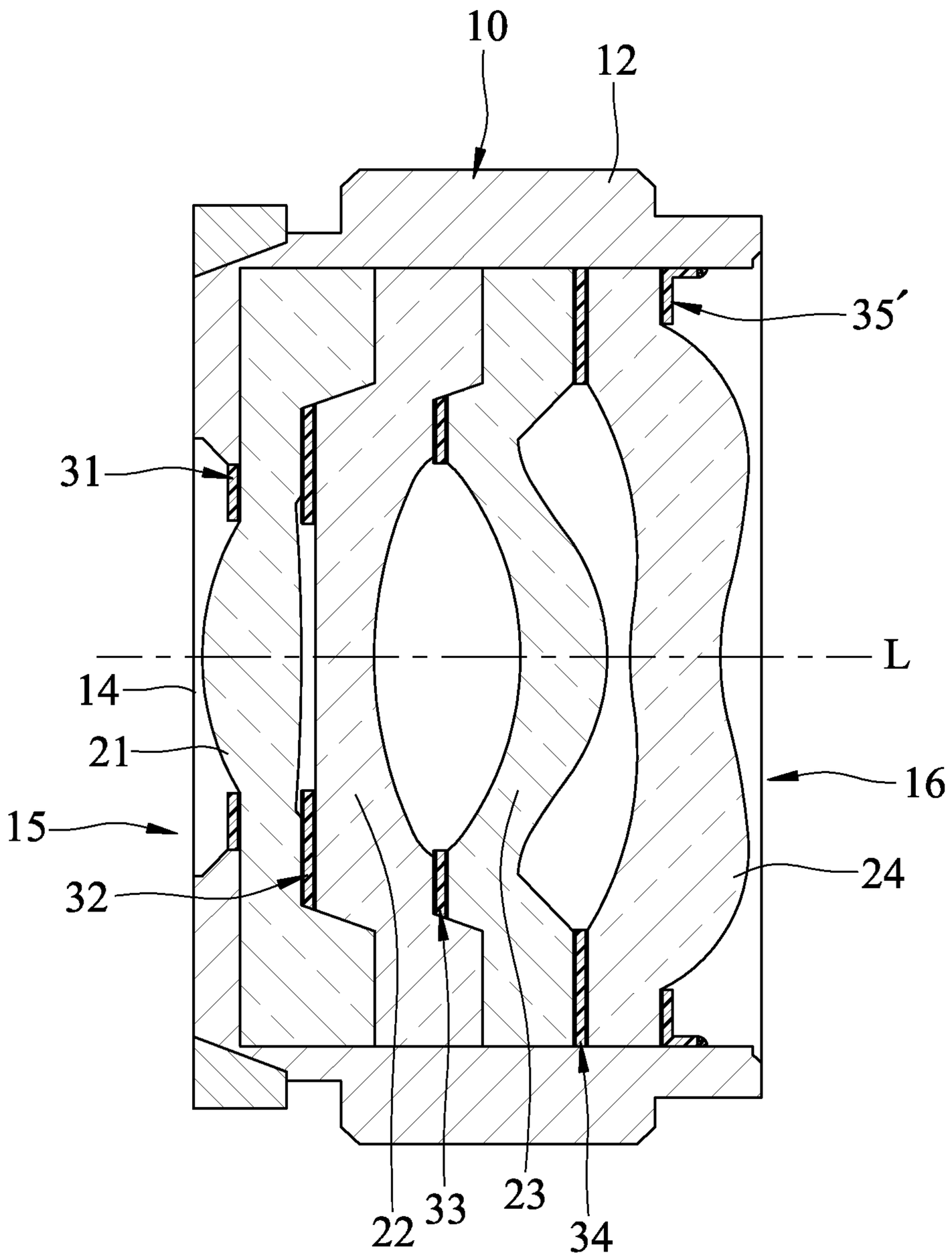

FIG.6

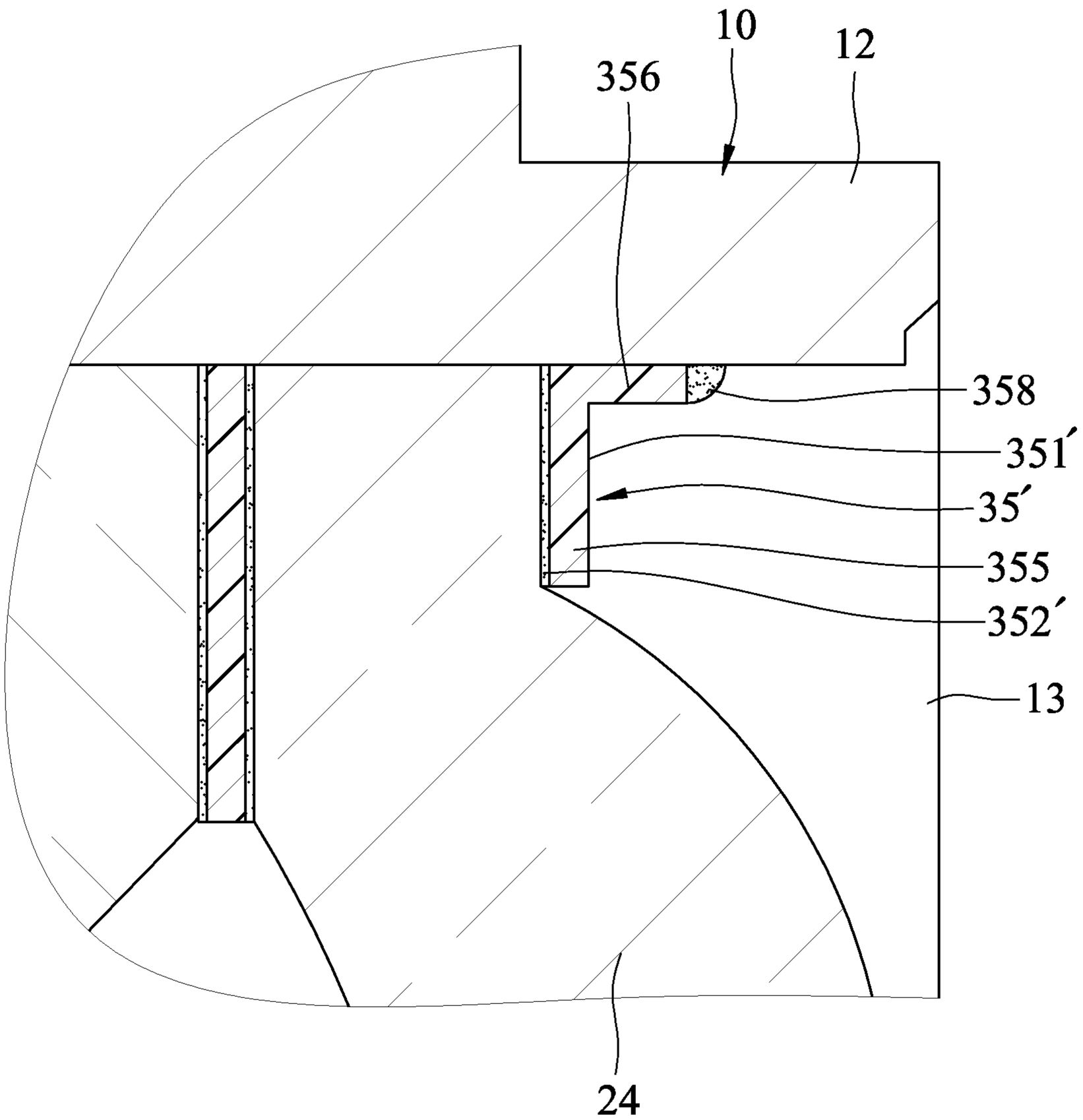

FIG.7

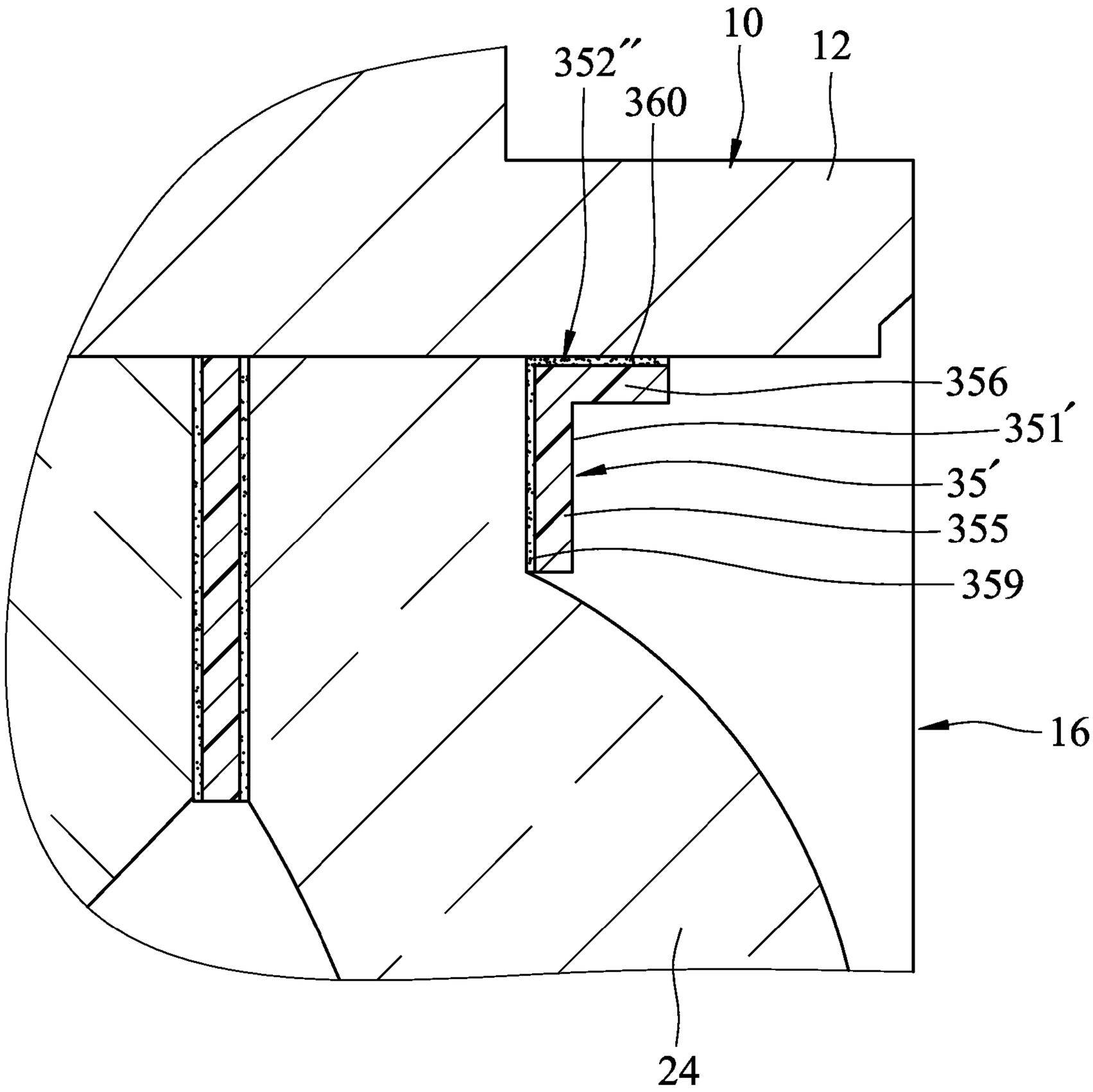

FIG.8

LENS ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority of Chinese Patent Application No. 201510336281.2, filed on Jun. 17, 2015.

FIELD

The disclosure relates to an optical apparatus, and more particularly to a lens assembly including an adhesive light-shielding member.

BACKGROUND

Referring to FIG. **1**, a conventional lens assembly includes a lens barrel **1**, a plurality of lenses **2** that are mounted in the lens barrel **1**, a plurality of light-shielding members **3** that are mounted among the lenses **2**, and a retaining ring **4** for retaining the lenses **2** in the lens barrel **1**. The lenses **2** are disposed in sequence from an object side **101** toward an image side **102** of the conventional lens assembly. For achieving better retainment of the lenses **2** relative to the lens barrel **1**, after the retaining ring **4** is mounted in the lens barrel **1** in a position proximate to the image side **102**, a plurality of adhesive elements **5** are disposed at an interconnection area between the retaining ring **4** and the lens barrel **1** in an adhesive-dispensing manner so as to secure the retaining ring **4** to the lens barrel **1**.

In the aforementioned conventional lens assembly, the light-shielding members **3** disposed among the lenses **2** are able to block flare around the lenses **2**. However, since the light-shielding members **3** are relatively small-sized and thin, dislocation during assembly is likely to occur, which adversely affects imaging quality. Moreover, the conventional lens assembly requires securing of the lenses **2** with the retaining ring **4** after the last one of the lenses **2** is mounted, followed by dispensing and curing the adhesive elements **5**. The assembling procedures of the conventional lens assembly are relative complicated.

Referring to FIG. **2**, another conventional lens assembly includes a lens barrel **6**, a plurality of lenses mounted in the lens barrel **6**, a plurality of light-shielding members **8** mounted among the lenses **7**, and an adhesive element **9** for retaining the lenses **7** in the lens barrel **6**. This conventional lens assembly differs from the abovementioned conventional lens assembly of FIG. **1** in the omission of the retaining ring (see FIG. **1**) to be mounted after mounting of the last one of the lenses **7** (referred to as the last lens **7** hereinafter) in the lens barrel **6** is completed. The last lens **7** is directly bonded to the lens barrel **6** through the adhesive element **9** disposed at the interconnection area therebetween.

However, apart from the adverse effect on imaging due to dislocation of the light-shielding members **8** during assembly, coating of the adhesive element **9** tends to interfere with an effective optical path of the last lens **7** and there is still room for improvement in the lens assembly.

SUMMARY

Therefore, an object of the disclosure is to provide a lens assembly that can alleviate at least one of the drawbacks of the prior arts.

According to the disclosure, a lens assembly includes a lens barrel, a plurality of lenses and at least one light-shielding member.

The lens barrel extends along an axis and includes a peripheral wall that surrounds the axis and defines a receiving chamber. The peripheral wall has an open end that is in spatial communication with the receiving chamber and adjacent to an image side of the lens assembly, and an aperture-forming end that is opposite to the open end and adjacent to an object side of the lens assembly.

The lenses are disposed in the receiving chamber defined by the peripheral wall in sequence along the axis between the aperture-forming end and the open end of the lens barrel.

The light-shielding member is disposed in the receiving chamber defined by the peripheral wall and includes an annular light-shielding body and at least one adhesive layer that is bonded to the annular light-shielding body. The annular light-shielding body is adjacent to at least one of the lenses and is positioned relative to the at least one lenses through the adhesive layer.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the disclosure will become apparent in the following detailed description of the embodiments with reference to the accompanying drawings, of which:

FIG. **1** is a sectional view of one type of conventional lens assemblies;

FIG. **2** is a sectional view of another type of conventional lens assemblies;

FIG. **3** is a sectional view of the first embodiment of a lens assembly according to the disclosure;

FIG. **4** is a fragmentary enlarged sectional view of FIG. **3**;

FIG. **5** is a partly enlarged sectional view of FIG. **3**;

FIG. **6** is a sectional view of the second embodiment of a lens assembly according to the disclosure;

FIG. **7** is a partly enlarged sectional view of FIG. **6**; and

FIG. **8** is a sectional view similar to FIG. **7** for illustrating the third embodiment of a lens assembly according to the disclosure.

DETAILED DESCRIPTION

Before the disclosure is described in greater detail, it should be noted that like elements are denoted by the same reference numerals throughout the disclosure.

Referring to FIGS. **3** and **4**, the first embodiment of a lens assembly according to the disclosure includes a lens barrel **10**, a plurality of lenses **21**, **22**, **23**, **24** and a plurality of light-shielding members **31**, **32**, **33**, **34**, **35**.

The lens barrel **10** extends along an axis (L) and includes a peripheral wall **12** that surrounds the axis (L) and defines a receiving chamber **11**. The peripheral wall **12** has an open end **13** that is in spatial communication with the receiving chamber **11** and adjacent to an image side **16** of the lens assembly, and an aperture-forming end **14** that is opposite to the open end **13** and adjacent to an object side **15** of the lens assembly.

The lenses **21**, **22**, **23**, **24** are disposed in the receiving chamber **11** defined by the peripheral wall **12** in the given order along the axis (L) between the aperture-forming end **14** and the open end **13** of the lens barrel **10**. Among the lenses **21**, **22**, **23**, **24**, the lens **21** is most adjacent to the object side **15** and the lens **24** is most adjacent to the image side **16**.

In this embodiment, there are five light-shielding members **31**, **32**, **33**, **34**, **35**. The light-shielding members **31**, **32**, **33**, **34**, **35** are disposed in the receiving chamber **11** defined by the peripheral wall **12**.

Among the light-shielding members **31**, **32**, **33**, **34**, **35**, the light-shielding member **31** is most adjacent to the object side **15** and serves as an aperture. The light-shielding member **31** includes an annular light-shielding body **311** and an adhesive layer **312** bonded to the annular light-shielding body **311**. The annular light-shielding body **311** is positioned relative to the lens **21** through the adhesive layer **312**.

The light-shielding member **32** is disposed between the lens **21** and the lens **22**, and includes an annular light-shielding body **321** and a pair of adhesive layers **322** bonded to the annular light-shielding body **321**. The annular light-shielding body **321** has a first surface **323** that is perpendicular to an extension direction of the axis (L) and bonded with one of the adhesive layers **322**, and a second surface **324** that is opposite to the first surface **323** and bonded with the other of the adhesive layers **322**. The annular light-shielding body **321** is bonded between the lens **21** and the lens **22** through the adhesive layers **322**.

The light-shielding member **33** is disposed between the lens **22** and the lens **23**, and includes an annular light-shielding body **331**, and a pair of adhesive layers **332** bonded to the annular light-shielding body **331**. The annular light-shielding body **331** has a first surface **333** that is perpendicular to the extension direction of the axis (L) and bonded with one of the adhesive layers **332**, and a second surface **334** that is opposite to the first surface **333** and bonded with the other of the adhesive layers **332**. The annular light-shielding body **331** is bonded between the lens **22** and the lens **23** through the adhesive layers **332**.

The light-shielding member **34** is disposed between the lens **23** and the lens **24**, and includes an annular light-shielding body **341**, and a pair of adhesive layers **342** bonded to the annular light-shielding body **341**. The annular light-shielding body **341** has a first surface **343** that is perpendicular to the extension direction of the axis (L) and bonded with one of the adhesive layers **342**, and a second surface **344** that is opposite to the first surface **333** and bonded with the other of the adhesive layers **342**. The annular light-shielding body **341** is bonded between the lens **23** and the lens **24** through the adhesive layers **342**.

Among the light-shielding members **31**, **32**, **33**, **34**, **35**, the light-shielding member **35** is most adjacent to the image side **16** and serves as a retaining ring. The light-shielding member **35** includes an annular light-shielding body **351** and an adhesive layer **352** bonded to the annular light-shielding body **351**. The annular light-shielding body **351** has a substantially rectangular cross section parallel to the extension direction of the axis (L) and is positioned relative to the lens **24** through the adhesive layer **352**. Moreover, the annular light-shielding body **351** has a first surface **353** that is perpendicular to the extension direction of the axis (L) and bonded with the adhesive layer **352**, and a second surface **354** that is opposite to the first surface **353** and applied with an adhesive element **358** through adhesive-dispensing techniques. The annular light-shielding body **351** is bonded to the lens **24** through the adhesive layer **352** and is secured to the peripheral wall **12** through the adhesive element **358**. As shown in Figures, the adhesive layer **352** may be coarse-surfaced.

During assembly of the lens assembly, by means of arrangement of the adhesive layers **322** on the first and second surfaces **323**, **324** of the light-shielding member **32**, respectively, the adjacent lenses **21**, **22** sandwiching the light-shielding member **32** therebetween are easily positioned relative to each other; by means of arrangement of the adhesive layers **332** on the first and second surfaces **333**, **334** of the light-shielding member **33**, respectively, the adjacent lenses **22**, **23** sandwiching the light-shielding member **33** are easily positioned relative to each other; and by means of arrangement of the adhesive layers **342** on the first and second surfaces **343**, **344** of the light-shielding member **34**, respectively, the adjacent lenses **23**, **24** sandwiching the light-shielding member **34** are easily positioned relative to each other. Consequently, flare around the lenses **21**, **22**, **23**, **24** is blocked and dislocation of the light-shielding members **32**, **33**, **34** during assembly of the lens assembly is prevented. The lens assembly thus formed has an improved and consistent image quality, is produced at a relatively low cost and is efficiently assembled.

Furthermore, since the light-shielding member **31** is most adjacent to the object side **15** and serves as the aperture and since the annular light-shielding body **311** is positioned relative to the lens **21** through the adhesive layer **312**, the aperture may have a simplified structure and design. Furthermore, since the light-shielding member **35** is most adjacent to the image side **16** and serves as the retaining ring and is secured to the peripheral wall **12** of the lens barrel **10** through the adhesive element **358**, the lenses **21**, **22**, **23**, **24** are subjected to pressing by the light-shielding member **35** so as to be secured in the lens barrel **10**. In addition, the annular light-shielding body **351** is positioned relative to the lens **24** through the adhesive layer **352**. Consequently, during assembly of the lens assembly, interference in the effective optical path is prevented and the required image quality is maintained. Additionally, by virtue of formation of the coarse-surfaced adhesive layer **352**, blocking of flare around the lenses **21**, **22**, **23**, **24** is enhanced.

Referring to FIGS. **6** to **7**, the second embodiment of a lens assembly according to the disclosure has a structure similar to that of the first embodiment except for the configuration of the light-shielding member **35'** that is most adjacent to the image side **16** and that serves as the retaining ring. The light-shielding member **35'** has an annular light-shielding body **351'** having an annular base portion **355** that is bonded to the lens **24** through an adhesive layer **352'** and that is perpendicular to the extension direction of the axis (L) and a peripheral extension portion **356** that extends from a periphery of the base portion **355** in the extension direction of along the axis (L). The peripheral extension portion **356** has a free end formed with the adhesive element **358** by adhesive-dispensing techniques so as to be connected to and positioned relative to the peripheral wall **12** therewith.

Similar to the first embodiment, by way of formation of the adhesive layer **352'** and the adhesive element **358**, the annular light-shielding body **351'** is positioned relative to the lens **24** and the light-shielding member **35'** is connected to and positioned relative to the peripheral wall **12**. Then, the lenses **21**, **22**, **23**, **24** are subjected to pressing by the light-shielding member **35'** with the assistance of the adhesive element **358** so as to be secured in the lens barrel **10**. Consequently, interference in the effective optical path is prevented during assembly of the lens assembly and the required image quality is maintained.

Referring to FIG. **8**, the third embodiment of a lens assembly according to the disclosure has a structure similar to that of the second embodiment except for the configuration of the adhesive layer **352"** bonded to the annular light-shielding body **351'** and omission of the adhesive element **358'** (see FIG. **7**). The adhesive layer **352"** includes an adhesive base portion **359** that is interposed between the

annular base portion **355** of the annular light-shielding body **351'** and the lens **24**, and an adhesive extension portion **360** that extends from the adhesive base portion **359** and is interposed between the peripheral wall **12** and the peripheral extension portion **356** of the annular light-shielding body **351'**.

Similar to the first and second embodiments, by way of formation of the adhesive layer **352"**, the annular light-shielding body **351'** is positioned relative to the lens **24** and the light-shielding member **35'** is connected to and positioned relative to the peripheral wall **12**. Then, the lenses **21**, **22**, **23**, **24** (see FIG. **6**) are subjected to pressing by the light-shielding member **35'** having the adhesive layer **352"** so as to be secured in the lens barrel **10**. Consequently, interference in the effective optical path is prevented during assembly of the lens assembly and the required image quality is maintained.

While the disclosure has been described in connection with what are considered the exemplary embodiments, it is understood that this disclosure is not limited to the disclosed embodiments but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

What is claimed is:

1. A lens assembly, comprising:

a lens barrel that extends along an axis and includes a peripheral wall surrounding the axis and defining a receiving chamber, the peripheral wall having an open end that is in spatial communication with said receiving chamber and adjacent to an image side of the lens assembly, and an aperture-forming end that is opposite to said open end and adjacent to an object side of said lens assembly;

a plurality of lenses that are disposed in said receiving chamber defined by said peripheral wall in sequence along the axis between said aperture-forming end and said open end of said lens barrel;

a first light-shielding member that is disposed in said receiving chamber defined by said peripheral wall and includes a first annular light-shielding body and a first adhesive layer bonded to said first annular light-shielding body, said first annular light-shielding body being adjacent to one of the lenses that is most adjacent to the open end and being positioned relative to said lens through said first adhesive layer, wherein said first light-shielding member has a first surface that is perpendicular to an extension direction of the axis and entirely bonded to said lens through said first adhesive layer and a second surface opposite to said first surface and facing said open end; and

at least one second light-shielding member that is disposed in the said receiving chamber defined by said peripheral wall and includes a second annular light-shielding body and at least one second adhesive layer bonded to said second annular light-shielding body, said second annular light-shielding body being adjacent to at least one of the lenses and being positioned relative to said at least one of lenses through said second adhesive layer.

2. The lens assembly of claim **1**, wherein said first adhesive layer is coarse-surfaced.

3. The lens assembly of claim **1**, wherein said first annular light-shielding body of said first light-shielding member has an annular base portion that is bonded to said lens through said first adhesive layer and perpendicular to the extension direction of the axis, and an peripheral extension portion that extends from said first annular base portion in the extension direction of the axis, said peripheral extension portion having a free end formed with an adhesive element so as to be connected to and positioned relative to said peripheral wall.

4. The lens assembly of claim **1**, wherein said first annular light-shielding body of said first light-shielding member has an annular base portion that is bonded to said lens through said first adhesive layer and perpendicular to the extension direction of the axis, and a peripheral extension portion that extends from said first annular base portion along the axis, said first adhesive layer including an adhesive base portion that is bonded between said base portion of said first annular light-shielding body and said lens, and an adhesive extension portion that extends from said adhesive base portion and is bonded between said peripheral wall and said peripheral extension portion of said first annular light-shielding body.

5. The lens assembly of claim **1**, wherein said second light-shielding member has two of said second adhesive layers, said second annular light-shielding body of said second light-shielding member having a first surface that is perpendicular to an extension direction of the axis and bonded with one of said second adhesive layers, and a second surface that is opposite to said first surface and bonded with the other of said second adhesive layers, said second annular light-shielding body being bonded between two adjacent ones of said lenses through the second adhesive layers.

6. The lens assembly of claim **1**, wherein said at least one lens is most adjacent to said aperture-forming end, and said second annular light-shielding body of said second light-shielding member are bonded to said at least one lens through said second adhesive layer.

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